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EVALUATION OF RED PINE CANKER ON THE CHIPPEWA, HURON-MANISTEE AND SUPERIOR NATIONAL FORESTS-- PLOT ESTABLISHMENT AND 1967 PROGRESS REPORT

Prepared by

James T. O'Brien

Pathologist

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ST. PAUL FIELD OFFICE, NORTHEASTERN AREA, STATE AND PRIVATE FORESTRY
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EVALUATION OF RED PINE CANKER ON THE CHIPPEWA, HURON-MANISTEE AND SUPERIOR NATIONAL FORESTS: PLOT ESTABLISHMENT AND 1967 PROGRESS REPORT 1/

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SUMMARY

In 1966, serious losses occurred in red pine plantations established in fall 1965 and spring 1966 on the Chippewa and Superior National Forests in Minnesota. Subsequently, examinations at the Eveleth Nursery revealed that many seedlings were internally lesioned or girdled, suggesting the name "pine canker". A similar problem caused high losses at the Chittenden Nursery at Wellston, Michigan, and in plantations on the Huron-Manistee National Forests. At first the Minnesota and the Michigan pine cankers were considered the same, but indications now are that they are different. The causes of the maladies have not been determined.

Permanent spread plots were established in plantations to determine whether the maladies spread to unaffected seedlings in the field, and to determine the mortality caused by them. The plots were established on the Chippewa and Superior National Forests in Minnesota in 1966 and on the Huron-Manistee National Forests in 1967, in plantations planted in spring 1965, fall 1965, and spring 1966.

The results of the initial (1966) and 1967 examinations of the Chippewa and Superior plots are inconclusive with regard to "spread", but indicate that the Minnesota malady caused little, if any, additional mortality on the plots in 1967. In comparison, the initial (1967) examination of the Huron-Manistee plots indicates that the Michigan malady is far more lethal than the Minnesota malady. The plots on the Huron-Manistee also reveal that, generally, "cankering" is more common, and mortality more abundant, on open sites than in sheltered plantations.

1/ These studies are being conducted by Northeastern Area, Forest Pest Control, State and Private Forestry in cooperation with the North Central States Forest Experiment Station and Region 9, National Forest Administration.

INTRODUCTION

In 1966, severe losses of seedlings occurred in the red pine plantations established in fall 1965 and spring 1966 on the Chippewa and Superior National Forests in Minnesota. Subsequent examinations at the Eveleth Nursery revealed that many seedlings possessed a girdling lesion beneath the bark of the stem close to the ground line. As a result of these findings, much of the nursery stock was destroyed.

A similar problem resulted in serious losses at the Chittenden Nursery, Wellston, Michigan. In affected seedlings internal lesions or girdles were found on the main stem at the bases of the older, dead needles. A check of seedlings from this nursery outplanted on the Huron-Manistee national forests revealed that seedlings affected by this malady had also been planted in the field, and serious losses occurred.

At first, the Minnesota and the Michigan maladies were considered the same. This led to the adoption of the inclusive term "pine canker" to designate the problems. However, indications now are that they are different, and they are herein separated by the name of the locality where found.

The causes of the maladies have not been determined. In the search for a fungal cause of the Minnesota problem some 9,000 isolations were made by Neil Anderson, Plant Pathologist at the University of Minnesota. Several fungi were obtained from cankered and lesioned areas on the seedlings, but their pathogenicity has not been established. Attempts by Darroll Skilling, Plant Pathologist at the North Central Forest Experiment Station, to isolate from Michigan nursery stock the fungus Scleroderris lagerbergii, which was once thought responsible for the Michigan problem, were unsuccessful. There is some evidence that a fungicide spray alleviates the problem in southern Michigan, but conclusive data will not be available until 1968. Adverse climatic factors may be involved in one or both of the problems, but this is not confirmed.

Permanent spread plots were established in red pine plantations to determine whether the maladies spread to unaffected stock in the field and to determine the frequency of mortality that can be expected among the affected trees. 2/ The plots

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2/ The study plan for this evaluation was written by Charles E. Cordell, Pathologist, formerly with Milwaukee Zone, Northeastern Area, now with the Asheville Zone, Southeastern Area.

were established on the Superior and Chippewa National Forests in 1966 and on the Huron-Manistee National Forests in 1967.

OBJECTIVES

The objectives of this evaluation are:

1. To determine the annual rate of spread of pine canker within specified red pine plantations on the Chippewa, Superior, and Huron-Manistee National Forests.

2. To determine the annual rate of mortality caused by the pine canker within these plantations.

3. To correlate the rate of (disease) spread, new "infections", and subsequent tree mortality.

METHODS AND PROCEDURES

Twentieth-acre plots were established in red pine plantations planted in the spring of 1965, fall of 1965 and spring of 1966. On the Chippewa and Superior National Forests 2 plots per plantation, or a total of 24 plots on the Chippewa and 30 on the Superior, were established. 3/ The Superior plantations are all on open sites (i.e. without overstory). The Chippewa plantations have at most a light overstory of aspen sprouts. On the Huron and Manistee, 3 plots per plantation were established in 24 plantations (12 plantations on the Huron and 12 on the Manistee). 4/ Two covered plantation sites (i.e. underplanted) and two open sites were selected for each of the three planting seasons on the latter two Forests. All plots were marked with corner stakes, and detailed maps were prepared to show locations of the plots and of each tree within the plots.

3/ The plots on the Chippewa and Superior National Forests were established by NFA personnel under technical supervision of S&PF.

4/ Establishment of the Huron-Manistee plots, and the Fall 1967 examinations of the Chippewa and Superior plots were accomplished by S&PF personnel under the supervision of W. R. Phelps, Plant Pathologist, formerly of the Division of Forest Pest Control.

Condition class (healthy, poor vigor, dying or dead) and symptom class (discolored, sparse, or missing foliage, absent or stunted candles, dead or absent buds, stem cankers) of each tree were determined at the time of plot establishment. The plots are to be re-examined at least once annually, and trees reclassified if changes occur.

RESULTS AND DISCUSSION

The plots on the Chippewa National Forest have been examined three times; at the time of plot establishment (fall 1966), in the spring of 1967, and in the fall of 1967. Table I presents the number of trees found cankered at each of these examinations. The data indicate considerably more trees cankered in spring 1967 than in either 1966 or fall 1967. Most of the trees found cankered in 1966 were classified "sound" in spring 1967, then returned to the "cankered" category in fall 1967. In many cases the reverse also occurred. Therefore, the spring 1967 data are of doubtful value. The 1966 and fall 1967 examinations agree reasonabley well. The data indicate that a total of 22 additional trees were cankered during the year, and 12 healed. However, the cankers are rather difficult to recognize and observational errors may account for the differences. Therefore, it cannot be concluded at this time that there was any "spread" of pine canker on the Chippewa National Forest.

The frequency of mortality and number of trees cankered on the Minnesota plots are shown in Table II. On the Superior plots, which have been examined twice (fall 1966 and fall 1967), the number of cankered trees apparently increased from 16 to 30, and no trees healed. Again, to ascribe the increase to "spread" rather than to observational errors is hazardous at this time. None of the cankered trees on the Superior plots died during the year. On the Chippewa, the number of cankered trees apparently increased from 127 to 137, and 11 cankered trees died.

The plots on the Huron-Manistee National Forests were examined only once, at the time of establishment (June, 1967), therefore no increase of decrease data are available. However, the 1967 observations are presented in Table III and compared with Chippewa and Superior fall 1967 data. To make all data as comparable as possible, only trees actually present in 1967 were included in the compilation of Table III. It shows that the percent of cankered trees is relatively similar in Minnesota and Michigan plots: Chippewa - 17.0, Superior - 4.2,

Huron - 8.8, and Manistee - 16.0. However, the percent of cankered trees that died differ greatly: Chippewa - 6.0, Superior - 0, Huron - 91.5, and Manistee - 63.3.

The 1967 data indicate that the Michigan type of "canker" is far more lethal than the Minnesota type. This conclusion is warranted if the following assumptions are valid:

1. Environmental stress on the seedlings is roughly the same in both areas.

2. Observational errors are approximately the same when a tree cankered by either type is examined.

3. A nursery seedling affected by the Michigan malady does not have a greater chance of being outplanted than one affected by the Minnesota malady.

4. The Minnesota canker does not cause higher initial mortality--the killed seedlings having disappeared before the observations were made--than the Michigan malady.

As demonstrated by the mortality frequency of non-cankered trees in 1967 (Table III), environmental stress was only slightly greater on the Manistee than on the Chippewa while the mortality of cankered trees was much more severe.

The assumption that observational errors are the same is probably valid with respect to dead trees, which can be examined closely. However, the accuracy of the identification of cankers on live trees is not known. Live trees are disturbed as little as possible when examined. It is proposed that efforts be made to check assumption 2 in 1968 by a supplemental sample dissection.

All plots on the Chippewa and Superior National Forests were established on open, or only lightly covered sites. These on the Huron-Manistee National Forests were equally divided between open and covered (i.e. with overstory) sites. The data presented in Table IV substantiates what casual field observations and surveys have already revealed about the malady. In general, fewer trees are "cankered", and mortality is lower on covered sites. This observation has led some to conclude that the malady is not nursery induced. However, other evidence leaves little doubt that the problem first occurred in the nursery. Possibly the malady "spreads" in the field on open sites, or perhaps the environmental conditions under the "cover" are more conducive to recovery (i.e. healing) than in the open.

RECOMMENDATIONS

Management practices

1. Continue prelift nursery inspections to detect cankering.

2. When possible, provide a partial overhead cover for outplanted young pines, particularly when canker damage has occurred in the nursery.

PLANS FOR FUTURE ACTION

An addition to the original plan, initiating a supplementary sampling technique is planned. This would involve removing some trees close to each plot for laboratory dissection. The objective would be to check the reliability of field observations.

TABLE I. Fluctuations in number of trees found cankered during the three examinations of pine canker plots on the Chippewa National Forest.

District	Plantation	No. of Trees examined	Number of Trees with canker			Number of trees reclassified					
						1966-1967(Spring)		1967(Spring) 1967(Fall)		1966-1967 (Fall)	
			1966	1967 (Sprg)	1967 (Fall)	Sound to Cankered	Cankered to sound	Sound to cankered	Cankered to sound	Sound to cankered	Cankered to sound
Cass Lake	178a	99	9	8	9	1	2	2	1	0	0
	177a	73	25	29	26	6	2	3	6	4	3
Bena	57a	73	0	1	1	0	1	0	0	1	0
Blackduck	2613	74	22	23	25	5	4	9	7	7	4
Walker	C-104	83	3	3	4	2	2	1	0	2	1
	C-51	78	36	39	34	4	1	1	6	0	2
	C-46	99	1	1	2	0	0	1	0	1	0
Remer	34-F	79	10	20	10	10	0	0	10	0	0
	32-b	59	12	16	12	4	0	0	4	0	0
Marcell	46-b	60	4	5	4	2	1	1	2	1	1
Dora Lk.	30	74	3	4	6	2	1	4	2	4	1
	W-Lake	84	2	4	4	2	0	2	2	2	0
Totals		935	127	153	137	39	13	24	40	22	12

TABLE II. Percent of tree mortality and number of trees found cankered on pine canker plots - Superior and Chippewa National Forests.

National Forest	Season Planted	No. of Trees Examined	Trees Dead (Percent)			No. Trees Cankered		
			1966	1967*	Increase	1966	1967*	Dead*
Superior	S-65	428	11.0	15.6	4.6	14	23	0
	F-65	228	31.6	38.6	7.0	0	2	0
	S-66	539	9.1	14.1	5.0	2	5	0
Forest Total or Average		1195	14.1	19.3	5.2	16	30	0
Chippewa	S-65	447	9.8	13.9	4.1	107	111	6
	F-65	182	24.7	27.5	2.8	12	13	2
	S-66	306	19.3	32.4	13.1	8	13	3
Forest Total or Average		935	15.8	22.6	6.8	127	137	11

* Missing Trees included

TABLE III. Comparison of the results of 1967 examinations of the pine canker plots to show differences in tree cankering and mortality on the Chippewa, Superior, and Huron-Manistee National Forests (Note: Plots without cankered trees are excluded, and missing trees are excluded from calculations.)

National Forest	Season Planted	Total Trees Present	Tree Mortality (in percent)		Trees Cankered (in percent)	
			Non-cankered Trees Dead	Cankered Trees Dead	Total Trees Cankered	Dead Trees Cankered
Chippewa	S-65	404	5.4	2.8	20.7	15.8
	F-65	150	11.7	15.3	8.7	11.1
	S-66	234	20.4	23.1	5.6	6.2
	Total or Ave.	788	11.8	16.0	17.0	9.4
Superior	S-65	332	4.5	0.0	6.9	0.0
	F-65	64	7.8	0.0	3.1	0.0
	S-66	324	6.5	0.0	1.5	0.0
	Total or Ave.	720	5.7	0.0	4.2	0.0
Huron*	S-65	312	44.3	92.3	12.5	22.5
	F-65	230	50.0	100.0	3.5	6.7
	S-66	264	12.9	87.5	9.1	40.4
	Total or Ave.	806	35.7	91.5	8.8	19.6
Manistee*	S-65	309	7.7	48.0	16.2	54.5
	F-65	202	13.0	72.0	12.4	43.9
	S-66	241	24.0	75.6	18.7	41.9
	Total or Ave.	752	14.2	63.3	16.0	45.8

* Open sites only, i.e. trees without overstory

TABLE IV. Comparison of plots in open and covered plantation sites - Huron-Manistee National Forests (Missing trees are not included in calculations)

National Forest	Exposure	Total Trees Present	Mortality (Percent)		Trees Cankered (Percent)	
			Non-cankered Trees Dead	Cankered Trees Dead	Total Trees cankered	Dead Trees cankered
Huron	open	807	35.7	91.5	8.8	19.6
	covered	437*	12.6	64.7	3.9	16.4
Manistee	open	752	14.2	63.3	16.0	45.8
	covered	682	7.2	42.4	4.8	23.0

* Two plantations with no plots containing cankered trees omitted.

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